

# Why is sad music pleasurable? A possible role for prolactin

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## Abstract

A hedonic theory of music and sadness is proposed. Some listeners report that nominally sad music genuinely makes them feel sad. It is suggested that, for these listeners, sad affect is evoked through a combination of empathetic responses to sad acoustic features, learned associations, and cognitive rumination. Among those listeners who report sad feelings, some report an accompanying positive affect, whereas others report the experience to be solely negative. Levels of the hormone prolactin increase when sad – producing a consoling psychological effect suggestive of a homeostatic function. It is proposed that variations in prolactin levels might account for the variability in individual hedonic responses. Specifically, it is conjectured that high prolactin concentrations are associated with pleasurable music-induced sadness, whereas low prolactin concentrations are associated with unpleasant music-induced sadness.

## Keywords

music, pleasure, prolactin, sadness

## Introduction

Sadness is a commonly reported music-related emotion. In a questionnaire study, Juslin and Laukka (2004) found that sadness was the eighth most commonly reported affective state induced by music (after happy, relaxed, calm, moved, nostalgic, pleasurable, and loving). In an exhaustive study, Zentner, Grandjean, and Scherer (2008) identify sadness as one of nine common emotions evoked by music (along with wonder, transcendence, tenderness, nostalgia, peacefulness, power, joyful activation, and tension). Along with joy, anger, and fear, sadness is one of four emotions commonly studied in research on music and emotion. Both adults and children readily identify particular passages as sounding “sad” (e.g., Terwogt & Van Grinsven, 1991), although recognition of some sadness-related cues (such as the Western minor mode) are known to be learned (Crowder, 1985; Crowder, Reznick, & Rosenkrantz, 1991; Dalla Bella, Peretz, Rousseau, & Gosselin, 2001; Kastner & Crowder, 1990). Nor is this phenomenon limited to Western music or modern times. Innumerable historical texts refer to music’s ability to either evoke or temper sadness, including ancient Egyptian, Chinese, Hebrew, Persian, Arabic, and Sanskrit sources. Moreover, laments, sorrow songs, dirges, elegies, cry-songs, and musical

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mourning traditions can be found throughout the world (e.g., Feld, 1982/1990; Fox, 2004; Magowan, 2007; Mazo, 1994; Seremetakis, 1991; Wilce, 2009).

At least in the case of Western-enculturated listeners, it is widely reported that some of the most profound and beautiful musical experiences are associated with sad music (Gabrielsson & Lindström, 1993). In describing such an experience, the 19th-century literary critic (and amateur pianist) Oscar Wilde wrote: "After playing Chopin, I feel as if I had been weeping over sins that I had never committed, and mourning over tragedies that were not my own" (Wilde, 1890, p. 2). As will be suggested later, Wilde's description appears to provide an apt characterization of the phenomenon of music-induced sadness – at least for some listeners.

Music-related sadness raises a number of questions of which three seem central. First, how does music convey or portray sadness? Second, does nominally sad music actually evoke a sad affect for listeners, or do listeners merely recognize the music as an apt portrayal, expression, or representation of sadness? Third, how is nominally sad music able to evoke pleasure? That is, what is the source of enjoyment for those listeners who purport to enjoy listening to sad music?

The problem of negative emotions in the arts has exercised the minds of philosophers since at least the time of the ancient Greeks. In portraying terror and horror, Aristotle wrestled with how tragic drama could possibly be enjoyable or beneficial for those who observed the spectacle. With regard to sad music, philosopher Stephen Davies has pointedly asked, if sad music makes people feel sad, why would they bother to listen (Davies, 1997)? A number of aesthetic philosophers have offered speculative accounts that attempt to resolve this apparent paradox (e.g., Davies, 1997; Kivy, 1980; Levinson, 1997); however, none of the extant theories has been tied to any empirical investigation of the matter.

A handful of experimental studies have been carried out addressing the enjoyment of sad films. Schramm and Wirth (2010), for example, carried out an empirical study suggesting that when a film version encourages viewers to assume the perspective of the protagonist of a sad film, the amount of enjoyment is less than when the film version encourages viewers to maintain a third-party observer perspective. They suggest that sad-film enjoyment is linked to complex emotional meta-appraisal. However, their results are also consistent with a simpler explanation, namely that viewers felt less sadness (and so reported greater enjoyment) when they empathized less with the protagonist's perspective.

Given that sadness is an unpleasant emotional state, one approach to this paradox raises doubts that music lovers truly feel sad when listening to nominally sad music. Ladinig and Huron (submitted) attempted to probe this issue by asking listeners about their experience of nominally sad music. Depending on the sampled population, between two-thirds and four-fifths of listeners agree with the statement "I enjoy listening to sad music." Between one-tenth and one-third of listeners agree with the reverse statement: "I don't really enjoy listening to sad music." Around one-tenth agree with the statement "Sad music is the music I most enjoy," and a slight percentage claim to actively "hate" sad music. Even when respondents are explicitly told that philosophers and scientists disagree about whether listeners truly feel sad when listening to nominally sad music, approximately a quarter of respondents claim that they "feel genuine sadness," with the remaining respondents claiming they "feel something else instead."

Although research in music and emotion tends to rely heavily on introspective reports, psychological research suggests that introspection can be highly inaccurate, especially when people are asked to identify the causes of feeling states (e.g., Graves, 2010; Lehrer, 2009; Wilson & Schooler, 1991). One might, therefore, choose to remain skeptical as to whether listeners do indeed feel sad when listening to nominally sad music. However, it is appropriate to begin by taking the introspective reports at face value. Perhaps the most important result from Ladinig

and Huron (submitted) is that not everyone is having the same experience when listening to nominally sad music. In particular, whether the music actually evokes sadness or not, there is broad disagreement among listeners about the capacity of sad music to evoke pleasure. Any theory of music and sadness should address this wide range of reported hedonic experiences.

## Sadness

Sadness is a negatively valenced affective state characterized by low physiological arousal, reduced physical activity, slumped posture, change of appetite, increased sleep, reduced verbal activity, reduced curiosity or engagement in the world, anhedonia, and rumination. When sadness is chronic or is not linked to some precipitating events, it is regarded as an affective pathology and deemed *depression* rather than *sadness* (DSM-IV, 1994).

Positive psychologists have suggested that there exists a bias in psychological research toward viewing many behaviors as delusional, error-prone, or pathological (e.g., Sheldon & King, 2001). Several researchers have argued that ordinary (non-depressive) sadness is a normal healthy emotion that should not be regarded as pathological (e.g., Horwitz & Wakefield, 2007; Wilson, 2008). Like physical pain, the psychic pain of normal sadness is considered an important adaptive behavior (Keedwell, 2008; Nesse, 1991; Nesse & Dawkins, 2010). Physical pain encourages an individual to avoid behaviors that might lead to tissue damage. Similarly, psychic pain also shapes behavior in important ways. Sadness commonly accompanies failures to achieve life goals, such as romantic, parental, social, or occupational goals. Sadness leads to rumination about life-station issues and re-evaluation of personal aspirations with ensuing changes of behavior that better match goals with reality (Nesse, 1991).

People commonly hold overly optimistic assessments of the likelihood of achieving certain goals (Ross & Nisbett, 1991). When experiencing sadness, one might suppose that people tend to become pessimistic; however, research suggests that we are at our most realistic when sad – a phenomenon called *depressive realism* (Alloy & Abrahamson, 1979). Compared with happiness, sadness encourages more detail-oriented thinking, less judgment bias, less reliance on stereotypes (Clore & Huntsinger, 2007), and greater memory accuracy (Storbeck & Clore, 2005). Listening to nominally sad music has been shown to induce depressive realism (Brown & Mankowski, 1993). That is, exposure to sad music encourages more accurate self-appraisals and more realistic assessments of the likelihood of certain outcomes. Nesse (1991) has suggested that the optimism that characterizes normal mental life encourages individuals to strive to achieve goals that might be attainable with effort; conversely, depressive realism provides a mental “grounding” or “reality check” when those same goals prove elusive.

In the same way that people experience physical pain differently, people experience psychic pain differently. Some individuals are more susceptible to sad feelings (Frey, 1985). Gender differences are commonly observed, with females more likely to experience sadness than males (e.g., George, Ketter, Parekh, Herscovitch, & Post, 1996; Lane, Jacobs, Mason, Wahby, Kasl, & Ostfeld, 1987). In addition, sad feelings become more common in later life (Seider, Shiota, Whalen, & Levenson, 2010). Individual differences appear to be a product of social and cultural norms, personal history, personality, physiology, and physical fitness (Keedwell, 2008).

## Whence sadness?

How do sounds convey or portray sadness? In addressing this question, a number of researchers have drawn attention to parallels between affective cues in speech and similar cues in music

(e.g., Juslin & Laukka, 2003; Laukka, Juslin, & Bresin, 2005; Patel, 2007). In the case of sadness, at least six sadness-related prosodic cues have been identified. Fairbanks and Pronovost (1939) studied the effect of pitch on emotional speech. They found that sad utterances exhibit a lower overall pitch (lower F0) and also exhibit a smaller pitch excursion. Apart from speech, low pitch and small pitch range have also been shown to convey sad affect using synthesized tones (Lieberman & Michaels, 1962).

Another prosodic cue for sadness is low intensity (Cowie et al., 2001; Scherer, 1986; Siegman & Boyle, 1993). Similarly, slower speech rate is also associated with sadness and depression (Breitenstein, van Lancker, & Daum, 2001; Siegman & Boyle, 1993). Yet another acoustical cue for sadness is poor articulation: sad speech exhibits more centralized vowels and lenition – characteristic of mumbling (e.g., Dalla Bella et al., 2001).

By way of summary, six acoustic factors are implicated in sad speech prosody: (1) low pitch, (2) small pitch movement, (3) quieter, (4) slower, (5) more mumbled articulation, and (6) darker timbre. With the exception of darker timbre, the first five acoustic factors of sad or depressed speech were already identified over a century ago by Emil Kraepelin (1899/1921).

In the case of music, correlational studies indicate that nominally sad music is lower in pitch (Huron, 2008; Huron, & Chordia, 2010), employs smaller interval sizes (Huron, 2008), is quieter (Turner & Huron, 2008), exhibits a slower tempo (Post & Huron, 2009), and involves darker timbres (Schutz, Huron, Keeton, & Loewer, 2008). A study of Japanese listeners by Balkwill, Thompson, and Matsunaga (2004) suggests that some of these acoustic properties appear to evoke sad connotations in at least one non-Western culture.

In assessing the cultural specificity or possible universality of such acoustic factors, it is important not to confuse *universal* with *innate* phenomena. An innate phenomenon is one that is biologically ordained, such as through a genetic determinant. A universal phenomenon, by contrast, is one that can be observed in all cultures. Biologists tell us that eye color is genetically determined but not everyone has the same color of eyes: eye color may be innate, but not universal. People in every culture form the belief that the sun will rise tomorrow, but no one has proposed that this belief arises from some innate biological disposition. That is, belief that the sun will rise may be universal, but not innate. Although many innate phenomena are also universal, few universal phenomena are innate. In fact, most universal phenomena are learned through shared environmental experiences. Any evidence for cross-cultural universality of auditory sadness cues should not therefore be regarded as evidence for innate origins.

## Origins of acoustical features of sad voice

One might ask what the six known acoustic features for sad voice share in common. They are all suggestive of low physiological arousal. In the peripheral nervous system, low arousal is linked to reduced acetylcholine, which in turn lowers both muscle tone and muscle reactivity (Siegal & Sapru, 2006). Low arousal would therefore be associated with relaxed and slow muscles. All of the peripheral muscles are affected, including the muscles of the vocal folds, tongue, lips, chin, as well as pulmonary muscles. Reduced muscle tone will cause the vocal folds to be less tense, resulting in a lower overall pitch (F0). A slower cricothyroid muscle will produce more sluggish pitch changes and therefore generate a more monotone prosody. When the muscles related to pulmonary function are relaxed, the result is lower subglottal air pressure, causing a quieter voice. The slower reactivity of tongue, lips, and chin will result in both a slower rate of speech and more slurred or mumbled articulation. When the zygomatic muscles of the face are relaxed, the lips tend to fall away from the teeth (in contrast to smiling, where the flesh is pulled taut against the teeth); this results in a longer effective vocal tract length with a

concomitant lower resonance – commonly described as a darker timbre (Tartter, 1980). In short, all of the acoustical characteristics of sad speech can be plausibly linked to the effects of low physiological arousal – in particular, the effects of reduced acetylcholine.

Sadness is not the only state that will cause low arousal. Low arousal is most commonly experienced when people are tired or sleepy. If, as proposed here, the features of sad speech are caused by low arousal, then these same features should be evident in tired or sleepy speech as well. Sleepy speech does indeed seem to be linked to quieter sound intensity, lower pitch, more monotone phonation, and mumbling. However, to our knowledge, no test has been carried out to determine whether sad and sleepy speech are poorly distinguished or indistinguishable. If it is attested that sad voice and sleepy voice are easily confused, then this would suggest that sad speech does not constitute a *signal* in the ethological sense (Hauser, 1996, pp. 9–10; Smith & Harper, 2003). Instead, it would imply that the characteristics of sad speech constitute an ethological *cue*, suggesting that the perception of sad affect arises from learned associations and is unlikely to be innate.

### Evoking sadness

One can readily understand how the presence of these acoustic properties might be interpreted by a listener as *representing* or *indicating* sadness. A more challenging question is how these acoustic features might lead some listeners to actually feel sad. Recall that approximately a quarter of surveyed listeners claim that nominally sad music makes them feel sad. If this introspection is accurate, then we need to consider how hearing lower pitch, slow tempo, darker timbre, etc. might actually *evoke* sadness in a listener. How visual or acoustic stimuli evoke emotions remains a topic of ongoing research. Most models of affect-induction, such as Huron (2002), Bachorowski and Owren (2002), and Juslin and Västfjäll (2008), include empathetic, associational, and cognitive/ruminative components among others. For the purposes of this study, we will focus on just these three components.

The term *empathy* has been used by writers in many different senses (e.g., Lipps, 1903/1906). Ekman (2003) defines empathy as the process by which emotions are evoked by witnessing someone else's emotional reaction. Empathy is thought to be the basis for feelings of compassion (Davis, 1996): we see someone cut themselves and we experience an unpleasant sensation in the pit of our stomach; we see someone in a helpless situation and tears tend to well up in our own eyes. While this is contentious, a number of researchers have suggested that mirror neurons provide a possible physiological path by which empathetic affective experiences might be generated (e.g., Gallese & Goldman, 1998; Iacoboni, 2008; Rizzolatti & Craighero, 2004). Similarly, neuroimaging research has shown that neural activation of perceived affect resembles neural activation of the associated felt affect (e.g., Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003). In a now classic experiment, Tania Singer and her colleagues (2004) carried out brain scans while they inflicted obvious pain on a romantic partner of the person being scanned. They found similar regions of brain activation in the observing romantic partner, suggesting that empathetic responses may involve emulating the emotional experience of others.

In the case of sad music, one might speculate that the acoustic features of sadness (low pitch, quiet, slow, etc.) would activate pertinent premotor mirror neurons that then evoke a feeling state akin to the affective state needed to generate such sounds (see also Laird, 2007). Since the pertinent motor neurons would be related to sad speech production, one might understand why voice-like sounds would have a special capacity for auditory-induced emotion. Whatever the specific psychophysiological mechanics of this process, it nevertheless seems reasonable that some sort of empathetic perception is possible, and that, at least for some listeners,

hearing nominally sad sounds (sounds exhibiting sadness-related acoustic features) will tend to evoke sad feelings.

Apart from this speculated empathetic pathway, at least two other psychological sources can be identified by which emotions can be evoked. Music psychologists have long noted that music may evoke emotions through learned associations. Inspired by Pavlov's recent work on the conditioned reflex, Valentine (1913/1914), for example, proposed that the minor mode evokes sadness in listeners via classical conditioning in which the minor scale becomes linked with grief-related contexts (such as funerals) and associations with lyrics conveying sad imagery.

Apart from learned associations, a third source of sadness is cognitive rumination. Ladinig and Huron (submitted) report the results of a survey study in which volunteers introspected during music-induced crying episodes. Within 2 minutes of the crying episode, volunteers were asked "What were you thinking about?" Of 19 volunteers, 17 indicated that they had been ruminating about life-station issues, such as thoughts about personal relationships, life stresses, or mortality. Such thoughts would normally be expected to lead to feelings of sadness, even in the absence of sad music. That is, exposure to nominally sad music appears to have provoked ruminations that were apt to contribute to feeling sad.

By way of summary, for at least some listeners, nominally sad music might lead to the phenomenal experience of feeling sad: (1) through empathetic responses to acoustic properties characteristic of sad speech – such as low, slow, quiet, mumbled, monotone, and dark timbres; (2) through arbitrary learned sad associations, such as the use of the minor mode for Western-enculturated listeners; and finally (3) via cognitive rumination – that is, through the sadness evoked by thinking sad thoughts spawned or encouraged by either or both the sad acoustic properties and sad associations.

## Lacrimation and lactation

Whether or not a listener experiences true sadness, overt behavior consistent with the phenomenal experience of sadness or grief is most evident in lacrimation (tears). Physiologists distinguish *irritant* from *psychic* tears. Irritant tears arise when chopping onions or when a foreign object is lodged in the eye. Psychic tears arise due to high emotion – most notably when emotionally pained, such as during grief – but also tears of happiness or laughter. Irritant and psychic tears are identical with one known exception: biochemist William Frey found that psychic tears exhibit a high concentration of the hormone prolactin (Frey, 1985).

Prolactin is a peptide hormone released primarily by the pituitary, but it is also synthesized within the central nervous system, by the immune system, by the uterus, and in the mammary glands. Systemic or blood-born prolactin is known to have access to the brain (Grattan & Kokay, 2008). As suggested by the name, prolactin is associated with the production of milk. But prolactin is released under a number of circumstances in both males and females. Prolactin concentrations are nearly 100 times normal levels during pregnancy. The production of milk is inhibited during pregnancy, however, by high levels of progesterone. At birth, prolactin levels drop to about 20 times normal levels. In addition, progesterone levels drop dramatically; without the inhibiting effect of the progesterone, the prolactin leads to the letdown response necessary for nursing (Freeman, Kanyicska, Lerant, & Nagy, 2000; Horseman, 2001).

Apart from lactation, prolactin also has important psychological effects. In particular, prolactin produces feelings of tranquility, calmness, well-being, or consolation – a positive "feel-good" state. For example, prolactin is released following sex, and the amount of

prolactin released is correlated with judgments of sexual satisfaction and relaxation (Brody & Krüger, 2006). The consoling effects of prolactin are also experienced during nursing, and help to encourage feeding behaviors. Especially during the last trimester of pregnancy, the consoling effects of prolactin may help offset the associated discomfort. Although many women experience pregnancy as highly stressful, many other women report pregnancy as one of the most enjoyable of life experiences – a phenomenon thought to be primarily attributable to the hedonic psychic effects of prolactin. Changes in prolactin levels following childbirth are implicated in postpartum depression. Women suffering from postpartum depression have significantly lower plasma prolactin levels than new mothers not suffering depression (Abou-Saleh, Ghubash, Karim, Krymski, & Bhai, 1998). Weaning also causes a drop in prolactin levels and so it is common for a weaning mother to feel sad or mildly depressed (Susman & Katz, 1988).

As already noted, psychic tears contain high levels of prolactin. Frey (1985) suggested that prolactin contributes to crying by reducing the threshold for crying onset. However, Vingerhoets and Scheirs (2000) found that the amount of crying among pregnant women does not fluctuate in accordance with increasing prolactin levels over the pregnancy. Eugster, Horsten and Vingerhoets (2001) concluded that prolactin is principally a result of crying rather than its cause.

In a study by Turner, Altemus, Yip, Kupferman, Fletcher, Bostrom, Lyons, and Amico (2002), negative and positive emotions were induced and plasma measures for prolactin, oxytocin, and adrenocorticotrophic hormone (ACTH) were obtained from 32 female participants. As in other studies, positive affect was linked with an increase in prolactin. However, at the same time, an increase in prolactin above baseline was also observed when a negative emotion was induced.

Since prolactin produces a comforting effect, the release of prolactin in response to grief, sadness, or other forms of stress is consistent with a homeostatic function. All physiological systems entail pairs of counteracting subsystems that regulate levels via simultaneous activation and inhibition. When experiencing physical pain, for example, endorphins are released that attenuate the pain through an analgesic effect. It appears that, when in a grief state, prolactin might serve an analogous function to endorphins during physical pain: the prolactin attenuates the psychic pain through a consoling effect. One might conjecture that the release of prolactin effectively limits the psychic pain and prevents the grief state from escalating uncontrollably.

Prolactin is released not just when crying, but also when sad – including episodes where the sadness is induced empathetically (Turner et al., 2002). In private communications to the author, two nursing mothers independently relayed similar experiences: both women reported involuntary lactation while watching a sad scene in a movie. Like music, the sadness portrayed in a movie is a fictional artifice rather than a real-world sadness-inducing incident. These observations are consistent with an empathetic release of both prolactin and oxytocin.

## **A good cry**

So how might nominally sad music induce a pleasurable state in at least some listeners? Consider again, the case of physical pain. Suppose you were hiking in a forest and were attacked by a wolf – producing a physical injury. The body would respond by releasing epinephrine and endorphins. The epinephrine is associated with an increase in physiological arousal characteristic of a fight or flight response. The endorphin release would produce an analgesic effect, as well as a hedonic effect. The analgesic effect would significantly attenuate the pain and so allow

you to focus on survival behaviors related to the wolf's attack. At the same time, the hedonic effects of the endorphins would tend to cap feelings of terror and help you to concentrate on situation-appropriate behaviors.

Now suppose we could fool the brain into thinking you had been attacked and injured, but you hadn't been. If our deception were successful, then the body would respond with the release of epinephrine and endorphins. However, without any actual feeling of pain, the analgesic and hedonic effects produced by the endorphins would result in a notably pleasant state. In fact, heroin addicts achieve this effect simply through the injection of exogenous opiates whose analgesic and hedonic effects mimic the effects of the body's own endogenous opiates. Now suppose we could fool the brain into thinking you were *psychically* injured. That is, suppose one could deceive or coax the brain into a state akin to the failure of an important emotional goal – such as a romantic, parental, social, or occupational failure. If, as suggested here, prolactin serves a similar homeostatic function to the endorphins released during physical pain, and if our mental deception were successful, then we might expect the body to respond with a release of prolactin. In light of prolactin's consoling or comforting effect, one could imagine that the resulting subjective experience would be rather pleasant. In short, sadness experienced in the absence of real psychic pain may be expected to produce a state that might reasonably be described as an enjoyable or "good" cry.

By way of summary, the theory proposed here suggests that, for at least some listeners, the acoustic features of nominally sad music emulate the acoustic properties characteristic of sad speech. Through an empathetic response, these cues bootstrap moderate feelings of sadness that may be amplified by learned associations and/or cognitive rumination (thinking sad thoughts). Whether or not a listener actually weeps, or has the feeling of incipient weeping, the state of sadness is nevertheless conjectured to cause a release of prolactin. A consoling effect ensues whether or not the listener regards the sadness to be warranted or vivid. At the end of the day, the listener is (cognitively) aware that they are merely listening to music, and that the grief-like feelings do not warrant the negative appraisals of a true tragedy.

## Individual differences

Recall that the surveys carried out by Ladinig and Huron (submitted) found that listeners report a wide variety of responses to nominally sad music. Some report feelings of actual sadness; others do not. Some find listening to sad music entirely unpleasant, whereas other listeners report that "sad music" is their most preferred type of music. If the theory offered here is correct, then a number of personal variables might be expected to contribute to the variability of responses. In the first instance, people are not equally susceptible to sadness. Research suggests that women are more empathetically aware of the emotional states of others, so some female listeners may be more likely to be moved to tears by sad music. At the same time, weeping is subject to strong cultural constraints, and so one might expect people from different cultures to respond differently.

Due to differences in musical experience, some people may have richer learned associations, and so be more susceptible to association-induced sadness. Many associations will be widely shared, such as the association of the minor mode with sadness for Western-enculturated listeners. Hence variations arising from learned associations may be both individual and cultural in origin.

Age may also play a role. For example, in a survey of emotional self-regulation of children between three and eight years of age, Saarikallio (2009) notes that children exhibit a clear preference for happy or positive music over sad music. For example, one parent commented:



“Melancholic music ... makes her sad, and she does not want those songs to be listened to and/ or sung.” Another parent responded: “[A]t church, the hymns make him sad, and he wonders why in the world do we need to have so sad songs” (p. 461).

In addition, personality or temperament may also play a role. For example, Ladinig and Schellenberg (2009) reported that sad feelings are more likely to be evoked in listeners who score high on agreeableness or neuroticism in a five-factor personality model. For participants who report music-induced sadness, those listeners who claim the experience to be enjoyable are more likely to score high on introversion or openness to experience. Similarly, Vuoskoski, Thompson, McIlwain and Eerola (submitted) found that openness to experience plays an important role in the enjoyment of sad music. We might also expect that different individuals may experience different levels of prolactin release and may exhibit different degrees of susceptibility to its consoling effects. For some individuals, the music may indeed succeed in evoking a sad or grief state. But if little prolactin is released, or the effect of the prolactin is muted, a listener might simply find the experience to have little or no redeeming quality. Such a listener would typically experience intense sadness, and so would tend to avoid listening to sad music – as suggested by Davies (1997). In short, the theory presented here might be empirically tested by correlating the variability in prolactin levels with the variability of subjective reports of pleasure induced by listening to nominally sad music.

Since the time of Aristotle, scholars have proposed that aesthetic context influences how listeners respond emotionally to any artistic object. For example, the detection that a stimulus is offered in an aesthetic context is central to Schubert’s (1996) model of sad music. A common interpretation of what is meant by “aesthetic context” is that the stimulus is cognitively discounted as unreal. That is, the object of attention is understood to be artificial. Brain research suggests a broad distinction between automatic subcortical responses mediated by cognitive cortical responses (e.g., LeDoux, 1996; see Huron, 2006, Ch. 2 for a musically pertinent exposition). One might expect that recognition of the fictional nature of a stimulus would lead to cortical inhibition of subcortical responses. In short, while empathy may be essential in order for acoustic cues to evoke sadness in a listener, cognitive assessment of the artificial nature of the stimulus may be essential in order for the sadness to be discounted as inconsequential. Individual differences in response to nominally sad music might therefore arise due to both variability in empathy and also variability in capacity to cognitively discount the stimulus as fictional.

## Discussion

Finally, let us return to the ontological question that aesthetic philosophers have found so compelling: Do listeners feel real sadness when listening to nominally sad music? Or are listeners responding to an apt representation or portrayal of sadness without a “true” or “genuine” sad affect? Recall Oscar Wilde’s description: “After playing Chopin, I feel as if I had been weeping over sins that I had never committed, and mourning over tragedies that were not my own” (Wilde, 1890, p. 2). Wilde’s introspective description would seem to be consistent with either interpretation. On the one hand, by using the phrase *I feel as if* (emphasis added), Wilde seems to suggest a certain distancing from actual sad feelings. On the other hand, the “as if” conditional is explicitly linked to the images of weeping over uncommitted sins or unrealized tragedies – suggesting that the grief-related feeling may be real, but arise from a source other than some normal recognizable source of grief or sadness. In light of the account offered here, Wilde’s description might well provide an apt characterization of the phenomenon of music-induced sadness – at least for some listeners.<sup>1</sup>

## Note

1. This article is an expanded version of Huron (2010).

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